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I, LEANNE MYNOTT, MANAGER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2003900164 for a patent by TECHSTREAM RESEARCH PTY LTD as filed on 15 January 2003.

WITNESS my hand this
Twenty-third day of January 2004

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VEHICLE SUBWOOFER WITH EXTERNAL FIELD CANCELLATION

FIELD OF THE INVENTION

The present invention relates to high sound pressure level low frequency loudspeakers in vehicles.

BACKGROUND OF THE INVENTION

Over the years a trend has developed worldwide to increase the sound pressure levels of audio systems in vehicles as well as to extend the frequency range of audio systems to lower frequencies. The disadvantage of this trend is an increase in the level of annoyance to neighbours and the public in general. Low frequencies are more difficult to constrain and can cause annoyance outside the vehicle for hundreds of metres. In some instances, authorities have had to set laws and regulations to control the level of noise pollution emanating from vehicles. However control requires enforcement which is costly and undesirable to those who enjoy loud music in vehicles.

There is clearly a conflict between the enjoyment of loud music in vehicles and acceptable noise levels outside the vehicles. The ideal would be to build audio systems that are loud inside the vehicle but quiet outside the vehicle.

SUMMARY OF THE INVENTION

The object of the present invention is to provide a low frequency loudspeaker system capable of high sound pressure levels in the vehicle with external sound field cancellation.

This object is achieved in the present invention by a loudspeaker system consisting of an electroacoustic transducer mounted in an enclosure that is

vented via a port through a suitable baffle into the passenger compartment of the vehicle.

For given amplifier power and enclosure size the sound pressure level capability is maximised at preferred frequencies by providing a non-flat acoustic response.

A separate electrical filter is used to flatten the sound pressure vs. frequency response of the system.

BRIEF DESCRIPTION OF DRAWINGS

Fig. 1 is a perspective view of a preferred embodiment of the loudspeaker system of the present invention with its protective panel displaced.

DETAILED DESCRIPTION OF THE INVENTION

Preferred embodiments of the present invention will now be described with reference to the accompanying drawings.

Referring to Fig. 1, a loudspeaker system **1** is to be mounted behind a baffle acoustically separating the loudspeaker system from the passenger compartment.

The loudspeaker system comprises an electroacoustic transducer **4** mounted in a circular cut-out **5** in an enclosure **6** which is vented via a duct **7** into the passenger compartment. The enclosure forms two acoustic filters, one on each side of the electroacoustic transducer. On one side is a first acoustic filter **8** which is vented into the listening area to convey sound to the passenger compartment. On the other side is a second acoustic filter **9** that is vented into a space other than the passenger compartment. The second acoustic filter consists of a protective panel **11** mounted above the electroacoustic transducer

cut-out by means of a set of stand-offs **12** that abut the protective panel to form channels to conduct sound away from the electroacoustic transducer. The filters are not set for flat response as is common in tuned prior art systems. They are set to provide maximum sound pressure level capability in certain frequency bands.

If the loudspeaker system is mounted in the trunk of a vehicle, the trunk may be open or closed, full or empty. The second acoustic filter helps to isolate the response from such changing conditions. It also provides a barrier to protect the electroacoustic transducer from physical damage by goods placed in the trunk. Depending on the design of the first acoustic filter, the second acoustic filter may be required to match phase shifts caused by the first acoustic filter.

Referring again to Fig. 1, an amplifier panel **13** is built into the enclosure forming part of a wall of the enclosure. The panel includes a heatsink with fins **14** exposed to air external to the enclosure **6**. The amplifier includes an electrical filter (not shown) that counteracts the non-linearities of the acoustic response to give an overall desired (typically flat) response at the listening position. The amplifier panel also includes an inverter (not shown), to provide the required voltages for the amplifier. The system may be wired into the same circuit as other electroacoustic transducers operating in a different frequency range and electrical filtering may be used to provide a crossover function.

The baffle must provide a substantial barrier to sound wave penetration with no substantial leaks between the trunk and the passenger compartment. Filtering on either side of the electroacoustic transducer must be designed to cause substantially the same sound pressure levels and phase shifts in low frequency

sound waves emanating from the vehicle at low frequencies. Accordingly low frequency sound waves emanating from the passenger compartment to the outside environment will be substantially 180 degrees out of phase with sound waves emanating from behind the baffle to the outside environment and of similar magnitude and will substantially cancel.

Finally it is to be understood that various alterations, modifications and/or additions may be introduced into the constructions and arrangements of parts previously described without departing from the spirit or ambit of the invention.

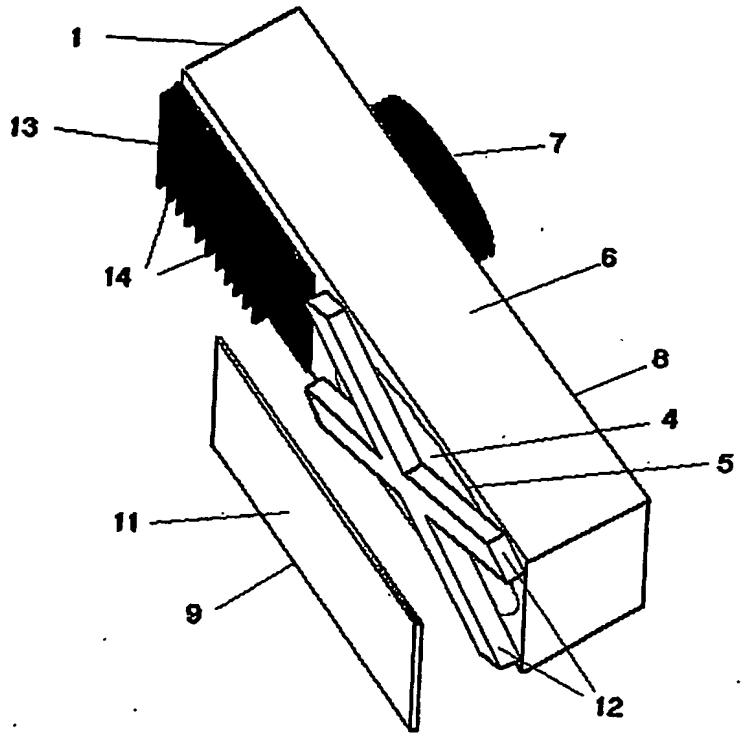

Fig. 1